Proteins & Water

Question Paper 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Biological Molecules
Sub Topic	Proteins & Water
Booklet	Theory
Paper Type	Question Paper 2

Time Allowed : **63 minutes**

Score : **/ 52**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Trypsin is a protease enzyme, which hydrolyses protein molecules, such as albumen, to amino acids.

A student investigated the effect of substrate concentration on the activity of trypsin. Six different concentrations of albumen were prepared and trypsin was added to each in turn. The student measured the time for albumen to break down and then calculated the rate of reaction. The investigation was carried out at 35 °C.

The student's results are shown in Fig. 3.1.

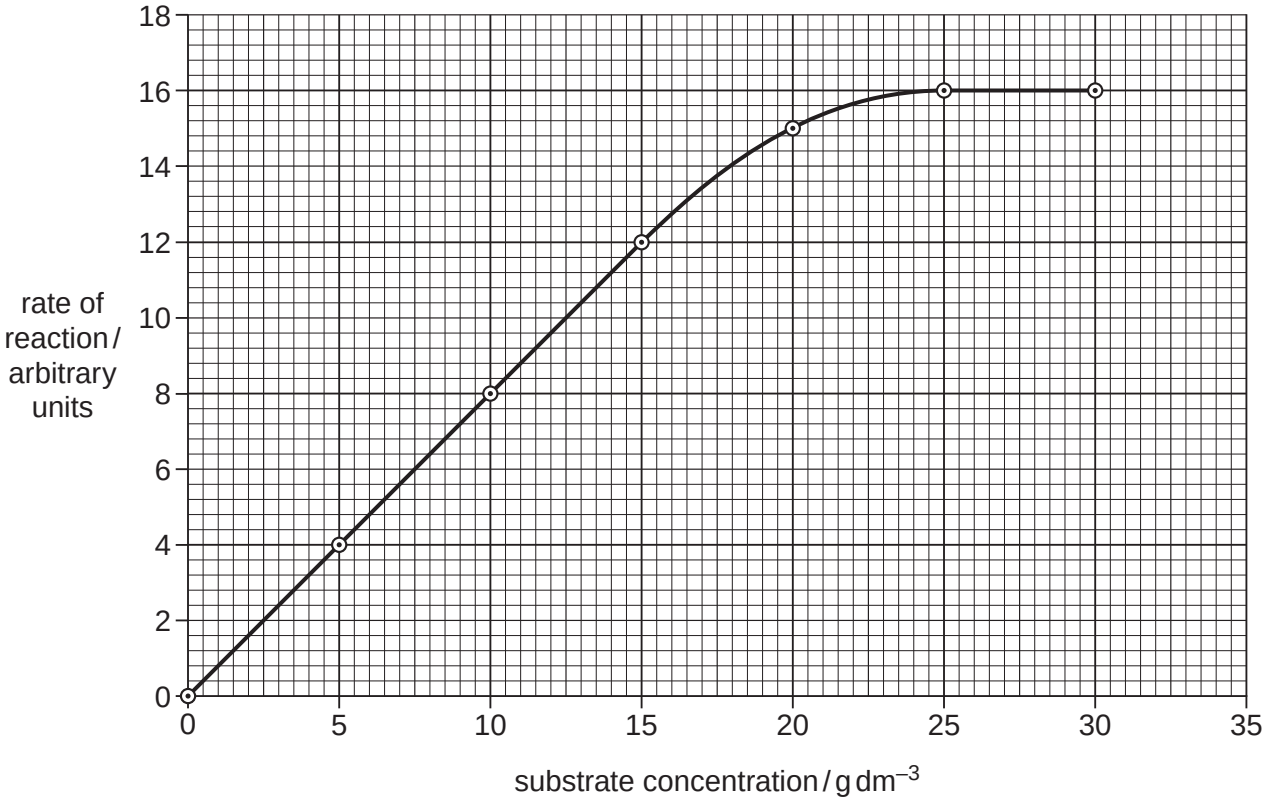

Fig. 3.1

(a) Explain the results shown in Fig. 3.1.

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..... [3]

(b) The student repeated the investigation at 25 °C.

Draw on Fig. 3.1 a curve to show the results that you would expect. [2]

During infections of the lungs, phagocytes move from the blood to the lining of the alveoli.

Phagocytes release the enzyme elastase (a protease) in order to digest a pathway through the alveolar wall. Most people produce a glycoprotein, alpha 1-antitrypsin (AAT), in the lung which inhibits elastase and so prevents widespread breakdown of alveoli. The inhibitory action of AAT was investigated using the enzyme trypsin.

(c) Describe **one** way in which AAT may act to inhibit the enzyme elastase.

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(d) Explain how you would adapt the student's investigation with trypsin to find out how AAT acts as an inhibitor.

You may use the space below to sketch the graph of the results that you might expect.

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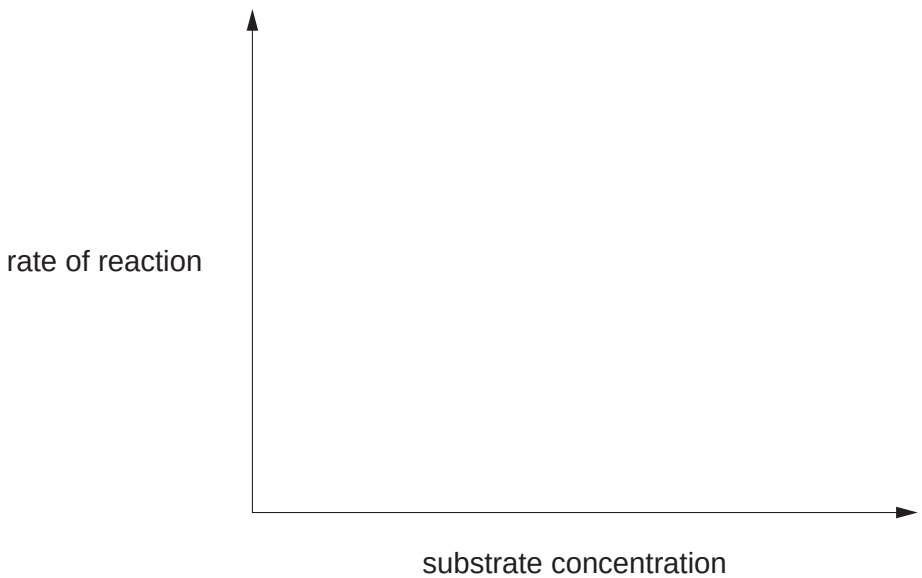

[4]

(e) Elastase breaks down the protein elastin. Describe the function of elastin in the lungs.

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..... [2]

(f) Tobacco smoke inactivates AAT. In long-term smokers this can result in the breakdown of much of the elastin in the lungs.

State the name of the condition that results from breakdown of elastin that occurs in some long-term smokers.

..... [1]

[Total: 15]

2 A group of membrane proteins which transport sugars out of cells have been identified and called SWEETs. They are found in the cell surface membranes of both animal and plant cells, including mammalian liver cells and rice mesophyll cells.

Each SWEET is a protein with seven coiled regions which together make a pore through a membrane bilayer as shown in Fig. 3.1.

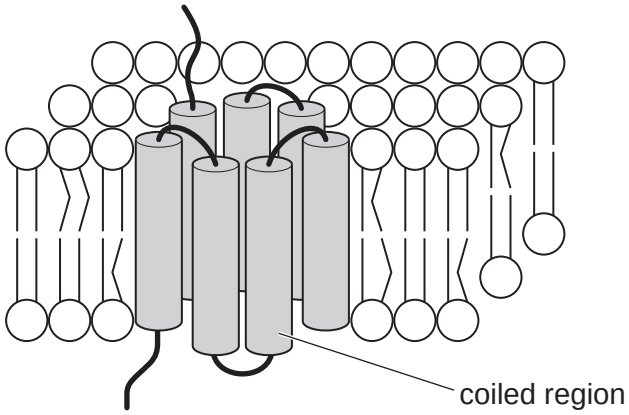

Fig. 3.1

(a) **(i)** Explain why, to enter or leave a cell, sugars need molecules such as SWEETS.

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(ii) Suggest how a SWEET is held within the membrane bilayer.

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(b) The bacterium, *Xanthomonas oryzae* (Xoo), causes the disease known as bacterial leaf blight in rice plants. It infects the intercellular spaces of the leaves of the host plant. Then, by switching on *SWEET* genes in the mesophyll cells, it stimulates the secretion of glucose into the intercellular spaces.

Several different **recessive** alleles have been found, in rice plants from different countries, which give resistance to bacterial leaf blight. All these alleles have a mutation in the promoter of the *SWEET* gene.

The effect of Xoo on wild type and resistant rice plants is compared in Fig. 3.2.

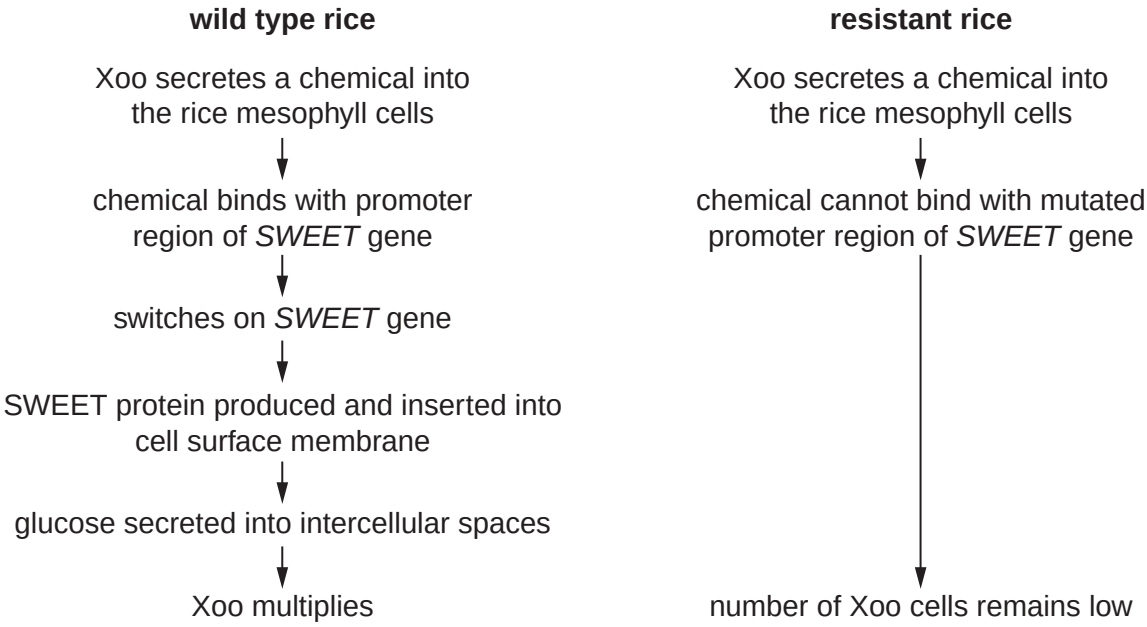

Fig. 3.2

(i) Using the information in Fig. 3.2, explain this resistance of rice plants to Xoo.

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(ii) Explain why it would be difficult to transfer this resistance into susceptible rice plants by genetic engineering.

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(iii) Explain why the presence of large numbers of Xoo in the intercellular air spaces of rice plants affects the ability of the plants to grow with their roots submerged in water.

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[Total: 14]

3 Fig. 5.1 shows five different biological molecules.

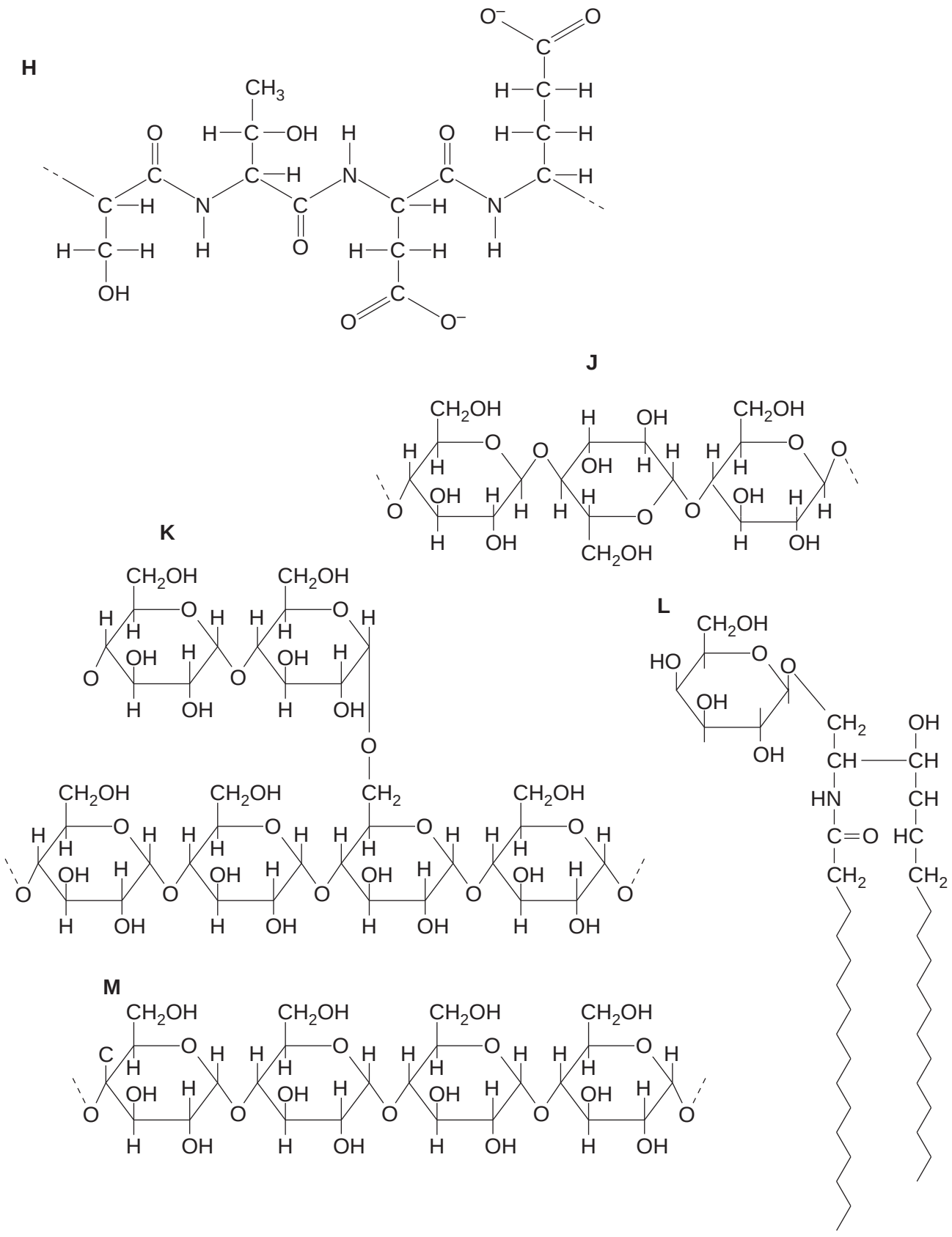


Fig. 5.1

Complete Table 5.1 by indicating which molecule matches each statement.

You may use each letter (**H** to **M**) once, more than once or not at all.

You should write only one letter in each box.

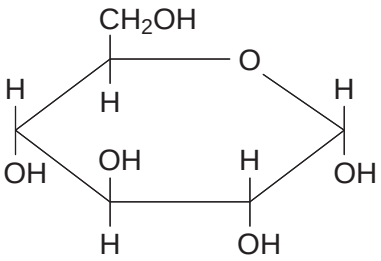
Table 5.1

statement	letter
contains peptide bonds	
part of the molecule forms the hydrophobic part of cell membranes	
contains 1-4 and 1-6 glycosidic bonds	
forms the primary structure of a protein	
used for energy storage in plants	
forms a helical structure	
the sub-unit molecule is β-glucose	

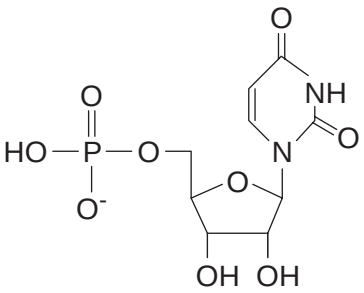
[Total: 7]

4 Fig. 3.1 shows seven biological molecules, labelled **D** to **K**.

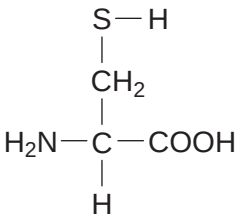
D



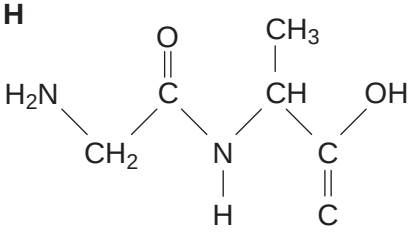
G



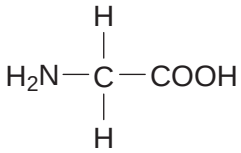
E



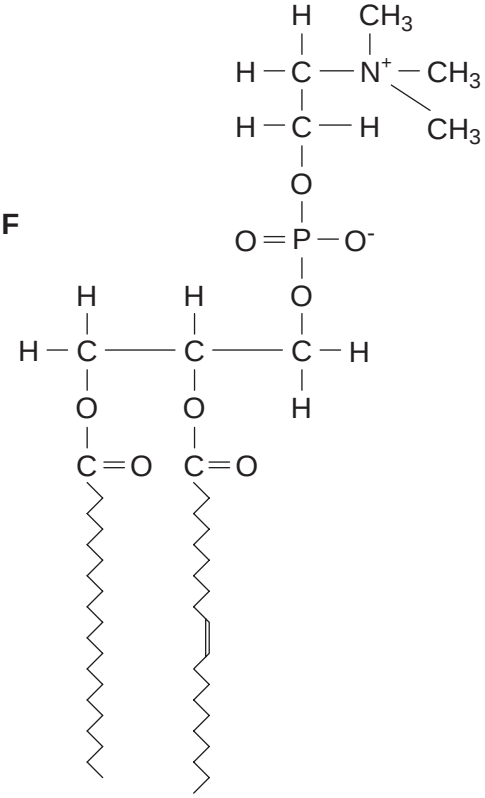
H



J



F



K

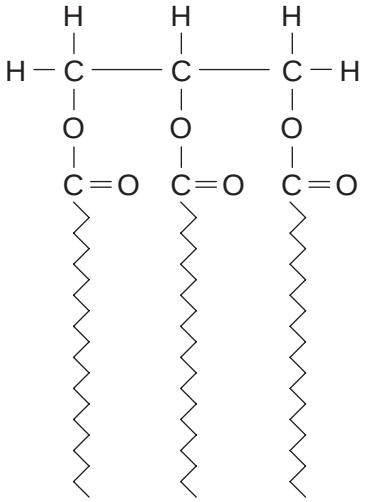


Fig. 3.1

(a) Table 3.1 contains statements about the biological molecules in Fig. 3.1.

Complete the table by selecting the biological molecule from Fig. 3.1 that matches each of the statements. Write the appropriate letter from Fig. 3.1 in the table. The first one has been done for you.

You may use each letter once, more than once or not at all.

Table 3.1

statement	letter
an amino acid that is a major constituent of collagen	**J**
a component of RNA	
a molecule that is polymerised to form glycogen	
a molecule with a peptide bond	
an important store of energy, insoluble in water	
a molecule with hydrophilic and hydrophobic regions	
an amino acid that forms disulfide (disulphide) bonds in proteins	

[6]

(b) Describe two ways in which the **structure** of DNA differs from the **structure** of collagen.

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2 .....

..... [2]

[Total: 8]

5 **(a)** Explain what is meant by *artificial selection.*

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(b) In a plant breeding programme, corn, *Zea mays*, was bred in an attempt to produce a high yield of protein in the grain.

The results of this programme are shown in Fig. 8.1.

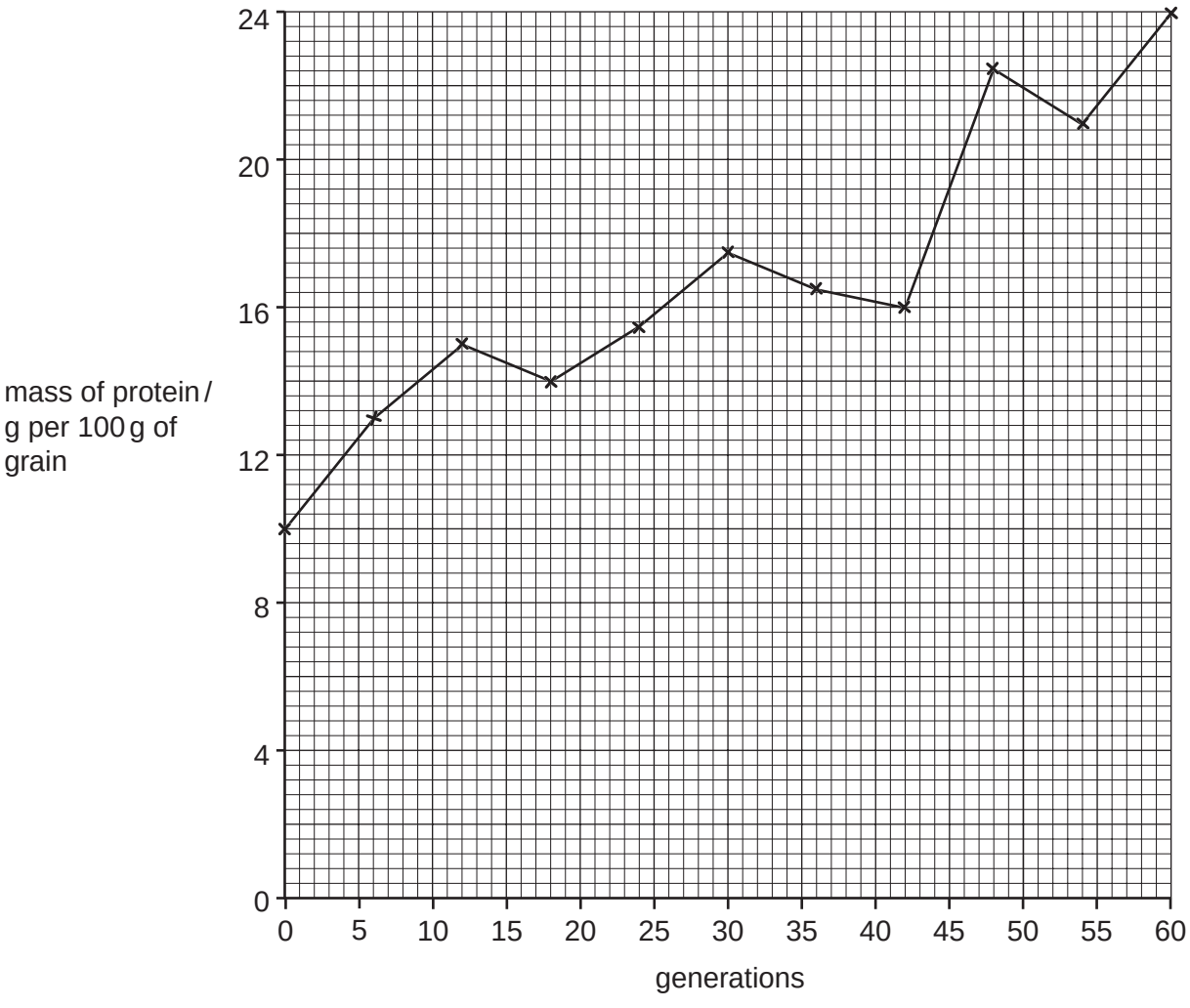

Fig. 8.1

(i) With reference to Fig. 8.1, calculate the percentage increase in grain protein by the end of the experiment.

Show your working.

Answer .....% [2]

(ii) Suggest why the protein yield does not increase steadily in each generation.

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.....[2]

[Total: 8]